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EFFECT OF AM FUNGUS (*Glomus fasciculatum*) AND OILCAKES AGAINST ROOT KNOT NEMATODE (*Meloidogyne incognita*) INFECTING BRISNJAL

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ABSTRACT

Pot culture experiment was conducted in the net house of the Department of Nematology, College of Agriculture, OUAT, Bhubaneswar to study **"The effect of AM fungus (*Glomus fasciculatum*) and oilcakes against root knot nematode (*Meloidogyne incognita*) infecting brinjal"**. The experiment comprised of 16 treatments in order of T1 (AM fungus @ 5g/m²), T2 (AM fungus @10g/m²), T3 (Neem cake @ 100g/m²), T4 (Neem cake @ 200g/m²), T5 (Mustard cake @ 100g/m²), T6 (Mustard cake @ 200g/m²), T7 (Sesame cake @ 100g/m²), T8 (Sesame cake @ 200g/m²), T9 (T1 +T3), T10 (T2 +T4), T11 (T1 +T5), T12 (T2 + T6), T13 (T1 + T7), T14 (T2 +T8), T15 (Carbofuran as standard check @ 0.3g a.i./m²), T16 (Untreated Inoculated Check). Each treatment was replicated thrice following complete Randomised Design. Results indicated that all treatments significantly increased the plant growth parameters and reduced root knot nematode population and other infection parameters over check. Also treatments where AM fungus was inoculated, there was significant rise in the population of AM fungus, its colonization in roots as well as availability of phosphorus in soil over check and other treatments. However among various treatments, T12 where mustard cake @ 200g/m² + AM fungus @ 10g/m² and T11 where mustard cake @ 100g/m² + AM fungus @ 5g/m² were applied in pot soil, results of plant growth parameters, population growth of root knot nematode and AM fungus as well as other infection parameters were found statistically at par. Both the treatments performing better than others contributed significantly increase in shoot length by 34.83% & 29.44%, number of leaves by 65.46% and 55.11%, fresh shoot weight by 77.17% & 70.14%, dry shoot weight by 116.78% & 113.86%, root length by 73.51% & 62.38%, fresh root weight by 69.33% & 54.42%, dry root weight by 93.78% & 79.09%, availability of phosphorus in soil by 76.3% & 63%, and colonisation of AM fungus in roots by 72.47% & 58.39% respectively with corresponding decrease in order of number of root galls by 94.16% & 90.66%, number of egg masses by 91.33% & 79.51%, root knot index by 57.17% & 42.82% and root knot nematode population by 92.63% & 91.13% over check (T16). Though T11 & T12 exhibited better result as compared to other treatments and over check (T16), yet in view of cost effective and low cost management option, application mustard cake @ 100g/m² + AM fungus @ 5g/m² in T11 is considered the most promising management option against root knot nematode (*M. incognita*) affecting brinjal crop.

KEYWORDS: Effect of AM Fungus (*Glomus fasciculatum*) and Oilcakes against Root Knot Nematode (*Meloidogyne incognita*) Infecting Brisnjal

INTRODUCTION

Brinjal (*Solanum melongena* L.) belonging to family solanaceae is a versatile vegetable crop grown throughout the world ; it is named differently as Aubergine, Egg plant, Melongene, Garden egg, and Guinea squash. It is called the "King of Vegetable". Brinjal plant is a delicate tropical perennial crop cultivated as a tender or half hardy in temperate climate. The stem is often spiny. The flower is white to purple.The egg shaped vegetable in world market is available in different colours such as white to yellow or green or reddish purple or dark purple or pink or black. Fruit botanically classified as berry, contains numerous small and smooth seeds which are edible but are bitter sometimes because they contain Nicotinoids and Alkaloids.

Egg plant is widely used in indian cuisine, e.g. Baingan ka Bharta, Baigan fry, sambar, chutney, curry, Achar, and dalma. Nutritionally Brinjal contains 5.88g carbohydrates, 3.53g sugar, 0.18g fat, 0.98g protein, 0.084mg vitamin B, 22mg vitamin C, 0.3mg vitamin E, 3.5mg vitamin K, 9mg Calcium, 0.23mg Iron,14mg Magnesium, 0.232mg Manganese, 24mg phosphorus, 229mg pottasium, and 0.16mg Zinc. Brinjal is also rich in medicinal value, significantly reducing body weight, Plasma Cholesterol level and aortic cholesterol content.

According to FAO, 2010, production of eggplant is highest concentrated with 90% output coming from five countries. China is the largest producer (58% of world's total output), while India is second (25% of world's output) followed by Egypt, Iran, &Turkey. More that 1,60,000 ha are devoted to the cultivation of brinjal in the world. In India as well as in Odisha, Brinjal is a commercial vegetable crop grown throughout the year. The plant is native to India. It is adapted to a wide range of climatic conditions from north to south and east to west. In hilly region, it is only grown in summer.

One of the major constraints on low yield of brinjal accentuates influence of various pests and diseases, of which the role of plant parasitic nematodes cannot be ruled out. Various plant parasitic nematodes such as ***Meloidogyne incognita, Rotylenchulus reniformis, Helicotylenchus dihystera, Hoplolaimus indicus, Tylenchorhynchus mashoodi, Pratylenchus zeae,*** **and** ***Criconemella ornata*** **are** associated with brinjal rhizosphere (Ray and Das,1989) but root knot nematode (*Meloidogyne incognita*) alone attributes 28.8% decrease in yield (Annon. 2007-11).

Though there are a few reports on effects of oilcakes and AM fungus in reducing population of plant nematodes, yet work to this effect in Odisha has not been taken up. So, it was felt necessary to study on :

"**Effect of AM fungus** ***(Glomus fasciculatum)*** **and oilcakes against root knot nematode** ***(Meloidogyne incognita)*** **infecting brinjal**" With the following objectives.

- Effect of AM fungus & oilcakes on various growth parameters of brinjal in relation to ***M. incognita*** infection.
- Effect of AM fungus & oilcakes on the population growth of root knot nematode along with its infection parameters as well as growth of AM fungus.

REVIEW OF LITERATURE

Jothi and Sundarababu (2000) conducted pot experiments to determine the effect of vesicular arbuscular mycorrhiza (VAM), *Glomus mosseae*, *G. fasciculation*, *G. intraradices* and *G. flavum* in presence of *M. incognita* on plant growth, 'P' fertility and reproduction of *M. incognita* in aubergine cv. CO2. *G. mosseae* recorded an increase in growth parameters and a decrease in *M. incognita* population with an increase in spore densities, which was at par with *G.*

fasciculation. The reproduction potential and fecundity of *M. incognita* were significantly reduced due to VAM application, as observed by the presence of fewer egg masses per gram of root. The development of gelatinous matrix was delayed and only fewer eggs per egg sac were present on the plants inoculated with VAM. In addition, the plants had lower root knot indices and yield considerably increased with *G. mosseae* followed by *G. fasciculation* compared to *M. incognita* alone. Cluster analysis showed that *G. fasciculation* inoculated with *M. incognita* performed better than *G. mosseae* will *M. incognita*. The contents of P was high in *G. mosseae* and *G. fasciculation*.

Tylka *et al.* (1991) investigated the effect of VAM fungi and soil P fertility on parasitism of soybean cultivars Bragg and Wright by soybean cyst nematode *Heterodera glycine* in field micro plot and green house experiments. VAM fungi increased height of both cultivars and yield of Wright in micro plots.

MATERIALS AND METHODS

The experiment was carried out in the Net house of the Department of Nematology, College of Agriculture O.U.A.T., Bhubaneswar during 2013-14. During the period of investigation, the various materials are used and methods followed, are categorised and discussed as follows.

Materials

Laboratory Materials

Glass Wares

Glass beakers, Petridishes, Measuring cylinder, Counting dish, Glass slides, Pipettes, 25 ml Volumatric Flasks, 100 ml Conical Flasks, Cover slips, Cavity Slides

Laboratory Chemicals

Formalin(40 % formaldehyde), Potassium hydroxide (KOH), Hydrochloric acid (HCl), Olsen's Reagent, Active charcoal, Ascorbic Acid, Sulphuric Acid, PNP (Para Nitro Phenol indicator), Acid fuchsin, Lactic acid, Glycerol, Phenol, Distilled water.

Other Materials

Aluminium pans, Aluminium wire gauge, Tissue paper, Filter paper, Polythene bags, Micropipette, Rubber band, Sieve, Bamboo stick, Needle, Electric heater, Meter scale, Threads, Envelops, Gunny bags and Earthen pots, Peak.

Equipments

Binocular stereoscopic microscope, Binocular research microscope, Hot air oven, Electronic Shaker, Spectrophotometer, Electronic balance and Autoclave.

AM Fungus (*Glomus fasciculatum)*

The AM species *(Glomus fasciculatum*) maintained on *maize* plant was obtained in sand culture where the spore count was about 340 chlamydospores per gram of sand.

Brinjal Variety

Brinjal seeds *(Solanum melongena* L.*) cv.* BB-54 was collected from Vegetable Improvement Scheme, OUAT on under utilized plants, Bhubaneswar.

Root Knot Nematode, *Meloidogyne Incognita* (Kofoid & White, 1919) Chitwood, 1949

The population multiplied on Brinjal from a single egg mass progeny was used for the experiment.

Oilseed Cakes

According to availability three different types of oilcakes i.e. Neem (*Azadirachta indica*), Mustard (*Brassica campestris*), Sesame (*Sesamum indicum*) was used.

METHODS

Experimental Site

The experiment conducted in pot culture during 2013-14 was entirely carried out in the net house of Department of Nematology, College of Agriculture, Bhubaneswar. All investigations and analysis were also done in the P.G. laboratory of the department as well as laboratory Department of Soil Science.

Experimental Design

The experiment was laid out in 15 cm size earthen pots following Complete Randomised Design (CRD) with sixteen treatments, each replicated thrice. The treatments were as follows:

T_1 - AM fungus, (*Glomus fasciculatum)* alone @ 5g/m²

T_2 - AM fungus, (*Glomus fasciculatum)* alone @ 10g/m²

T_3 - Neem cake (*Azadirachta indica*) alone @ 100g/m²

T_4 - Neem cake (*Azadirachta indica*) alone @ 200g/m²

T_5 - Mustard cake (*Brassica campestris*) alone @ 100g/m²

T_6 - Mustard cake (*Brassica campestris*) alone @ 200g/m²

T7 - Sesame cake (*Sesamum indicum*) alone @ 100g/m²

T8 - Sesame cake (*Sesamum indicum*) alone @ 200g/m²

T9 - T1 + T3

T10 - T2 + T4

T11 - T1 + T5

T12 - T2 + T6

T13 - T1 + T7

T14 - T2 + T8

T15 - Carbofuran as standard check @ 0.3g a.i./m²

T16 - Untreated Inoculated Check

RESULTS AND DISCUSSIONS

Root Knot Nematode Infection Parameters and Its Population

Number of Galls (Table 1; Figure 9): Analysis of data on number of galls produced by root knot nematode revealed that there was significant reduction in number of galls in different treatments over check. There was highest reduction in number of galls in T12 (94.16%) followed by T11 (90.66%), T14 (88.62%), T2 (88.04%), T15 (87.16%), T13 (85.71%) and T10 (85.41%) over check in descending order, the lowest being 61.22% in T3. Number of galls in T12 was found statistically at par with T2, T11, T14 and T15, But significantly different from rest of the treatments. Also it was noticed that treatments where different oilcakes were applied alone, the number of galls produced by root knot nematode were comparatively more than the corresponding treatments where AM fungus and olicakes were applied together. Moreover, as compared to T1 & T2 where AM fungus were inoculated alone, there was more reduction in number of galls in T11, T12 & T13, T14 where mustard cake and sesame cake respectively were applied along with AM fungus.

Table 1: Root Knot Nematode (*Meloidogyne Incognita*) Infection Parameters and its Population Growth in Brinjal Cv. BB-54.(Each Data Represents Average of 3 Replications.)

Treatment	No. of Galls	% of Decrease	No. of Egg mass	% of Decrease	RKN Population	% of Decrease	RKN Index	% of Decrease
T1 (AM Fungus @ 5g/m²)	20.67 (4.51)*	81.92	10 (3.16)*	76.37	196.67 (2.29)**	90.25	3	35.76
T2 (AM Fungus @10g/m²)	13.67 (3.67)	88.04	9 (3)	78.73	165.33 (2.21)	91.81	2.67	42.82
T3 (Neem @ 100g/m²)	44.33 (6.62)	61.22	28 (5.25)	33.85	389 (2.56)	80.73	4	14.34
T4 (Neem @ 200g/m²)	28.67 (5.33)	74.92	21 (4.58)	50.38	291.33 (2.46)	85.57	3.33	28.69
T5 (Mustard @ 100g/m²)	32.33 (5.68)	71.72	20 (4.45)	52.75	236.33 (2.37)	88.29	3.67	21.41
T6 (Mustard @ 200g/m²)	21 (4.58)	81.63	14 (3.74)	66.92	193.67 (2.28)	90.40	3	35.76
T7 (Sesame @ 100g/m²)	31 (5.47)	72.88	19.33 (4.34)	54.33	229 (2.35)	88.65	3	35.76
T8 (Sesame @ 200g/m²)	20.33 (4.5)	82.21	13 (3.58)	69.28	192 (2.28)	90.49	3.67	21.41
T9 (T1 +T3)	23 (4.78)	79.88	15 (3.84)	64.56	228.67 (2.35)	88.67	3	35.76
T10 (T2 +T4)	16.67 (4)	85.41	11.67 (3.34)	72.43	174 (2.24)	91.38	3	35.76
T11 (T1 +T5)	10.67 (3.19)	90.66	8.67 (2.88)	79.51	179 (2.23)	91.13	2.67	42.82
T12 (T2 + T6)	6.67 (2.47)	94.16	3.67 (1.88)	91.33	148.67 (2.17)	92.63	2	57.17
T13 (T1 + T7)	16.33 (4.02)	85.71	12 (3.45)	71.65	182.67 (2.25)	90.95	3	35.76
T14 (T2 +T8)	13 (3.39)	88.62	10.67 (3.04)	74.79	169 (2.23)	91.62	2.67	42.82
T15 (Carbofuran @ 0.3g a.i./ha)	14.67 (3.77)	87.16	8.33 (2.87)	80.32	158.33 (2.19)	92.15	2.67	42.82
T16 (Untreated Check)	114.33 (10.65)		42.33 (6.49)		2019 (3.3)		4.67	
L.S.D. (0.05)	1.40		1.09		0.15		0.71	

*** Figures in parentheses are square root transformed values.**

**** Figures in parentheses are log. transformed values.**

Brinjal (*Solanum melongena* L.) is a commercial vegetable crop grown all the year round. This crop is highly prone to invasion by a variety of pests and diseases, of which the role of plant parasitic nematodes cannot be ruled out. Among various economically important plant parasitic nematodes, root knot nematodes, *Meloidogyne incognita* (Kofoid &

White, 1919) chitwood,1949 is well recognized as the major limiting factor for profitable higher production of brinjal. So application of chemical nematicide as curative measure is the immediate management option on farmer's front to safe guard the crop against root knot nematode. But prohibitive cost of nematicides, non availability of many nematicides in the market, high residual toxicity, health hazard, environmental pollution in general and ground water pollution in particular pose serious concern on the use of chemical pesticides. Hence, alternate ecofriendly management option to suppress the root knot nematode in brinjal is either to explore the potentiality of bioagents or use of oilcakes as organic amendment or integration of bioagents and oilcakes to enrich the viability and production of spore load of bioagents on organic substrate for effective management of root knot nematode. Keeping abreast of the aforesaid various possibility of environment friendly management options against root knot nematode, the present experiment was designed to study the "The effect of AM fungus (*Glomus fasciculatum*) and oilcakes against root knot nematode (*Meloidogyne incognita*) infecting brinjal", where oilcakes such as neem cake, mustard cake, sesame cakes and AM fungus (*Glomus fasciculatum*) each at lower and higher dosages were incorporated in pot soil prior to sowing seeds. Apart from these treatments carbofuran standard check nematicide was also included as one treatment being replicated thrice. All the treatments were compared with each other and over check after statistically analysis of data.

CONCLUSIONS

A pot experiment on " Effect of AM fungus (*Glomus fasciculatum*) and oilcakes against root knot nematode (*Meloidogyne incognita*) infecting brinjal " was carried out in the net house, Department of Nematology, College of Agriculture, OUAT, Bhubaneswar during 2013-14 with the objective to study the effect of AM fungus & oilcakes on various growth parameters of brinjal in relation to *M. incognita* infection and also its effect on population growth of root knot nematode along with its infection parameters as well as growth of AM fungus. The experiment comprising of 16 treatments, each replicated thrice following Complete Randomised Design (CRD) were T1 (AM fungus @ 5g/m²), T2 (AM fungus @10g/m²), T3 (Neem cake @ 100g/m²), T4 (Neem cake @ 200g/m²), T5 (Mustard cake @ 100g/m²), T6 (Mustard cake @ 200g/m²), T7 (Sesame cake @ 100g/m²), T8 (Sesame cake @ 200g/m²), T9 (T1 +T3), T10 (T2 +T4), T11 (T1 +T5), T12 (T2 + T6), T13 (T1 + T7), T14 (T2 +T8), T15 (Carbofuran as standard check @ 0.3g a.i./m²), and T16 (Untreated Inoculated Check). Brinjal seed var. BB-54 susceptible to root knot nematode were sown in the replicated pots containing 1kg steam sterilized soil each after the pot soil was treated with AM fungus, oilcakes and carbofuran in appropriate dosage as per the treatments designed. Fifteen days old brinjal plant in each replicated pot was inoculated with 1000 J2 of *M. incognita.* Intercultural operation and watering were attended in time. The experiment was terminated 60 days after sowing seeds. Final observation on plant growth parameters such as shoot & root length, Fresh shoot & root weight, Dry shoot & root weight, number of leaves and population growth of root knot nematodes along with its infection parameters in respect of number of galls, egg masses root knot index as well as population growth of AM fungus along with its extent of colonization in roots and phosphorus content in soil were recorded. Recorded replicated tabular data were subjected to statistical analysis for each parameter for comparison of different treatments.

From the experimental findings it was evident that all treatments significantly increased the plant growth parameters and reduced root knot nematode population along with various infection parameters viz. number of galls, number of egg masses and root knot index over check. Also there was significant rise in the population of AM fungus along with its colonization in roots as well as availability of phosphorus in soil in T1, T2, T9, T10, T11, T12, T13, & T14 as compared to other treatments where AM fungus and oilcakes alone and in combination were amended in pot soil.

However, among various treatments, T12 where mustard cake @ 200g/m² + AM fungus @ 10g/m² and T11 where mustard cake 100g/m² + AM fungus @ 5g/m² were applied in pot soil, results of plant growth parameters, population growth of root knot nematode as well as AM fungus and their infection parameters were found statistically at par. Both the treatments performing better than others contributed significantly increase in shoot length by 34.83% & 29.44%, number of leaves by 65.46% and 55.11%, fresh shoot weight by 77.17% & 70.14%, dry shoot weight by 116.78% & 113.86%, root length by 73.51% & 62.38%, fresh root weight by 69.33% & 54.42%, dry root weight by 93.78% & 79.09%, availability of phosphorus in soil by 76.3% & 63%, and colonization of AM fungus in roots by 72.47% & 58.39% respectively with corresponding decrease in order of number of root galls by 94.16% & 90.66%, number of egg masses by 91.33% & 79.51%, root knot index by 57.17% & 42.82% and root knot nematode population by 92.63% & 91.13% over check (T16). Though T11 &T12 exhibited better result as compared to other treatments and over check (T16), yet in view of cost effective and low management option, application of mustard cake @ 100g/m² + AM fungus @ 5g/m² is considered the most promising management option against root knot nematode (*M. incognita*) affecting brinjal crop. However, the present finding needs further study of these treatments in microplot/ field condition for more concrete result.

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APPENDICES

Plate 1: Effect of AM Fungus, Root Knot Nematode & Oilcakes on Brinjal Plant in Net House